

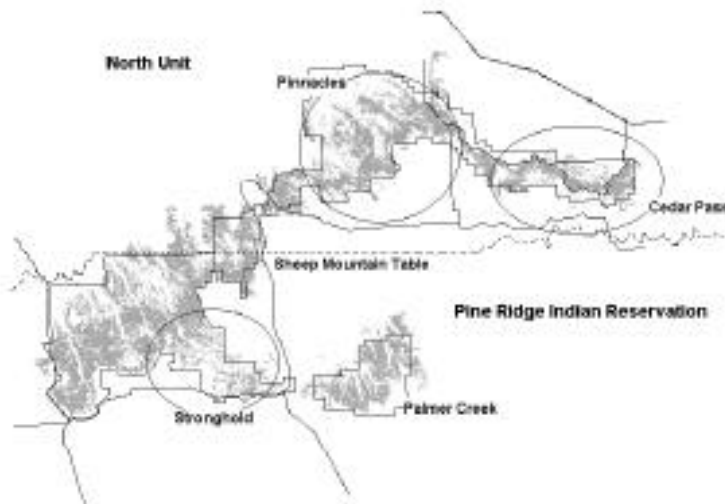
## Bighorn sheep restoration in Badlands National Park, South Dakota: lessons for cooperation

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### Introduction

Badlands National Park is located in western South Dakota and consists of three units totaling more than 240,000 acres (Figure 20.1). The North Unit includes the Pinnacles area to the west, located within the 64,000-acre Sage Creek Wilderness Area, and the Cedar Pass area to the east. Much of the north unit is bordered by the Buffalo Gap National Grassland, which is administered by the U.S. Forest Service (USFS). To the south, the Stronghold and Palmer Creek units are located within the Pine Ridge Indian Reservation. These units are managed under a cooperative agreement between the Oglala Lakota and the National Park Service (NPS).

### Badlands National Park, South Dakota



**Figure 20.1. Badlands National Park, South Dakota. Shaded areas represent badlands formations. Dotted line represents Pine Ridge Indian Reservation boundary. Solid lines represent roadways or park boundaries. Ellipses represent bighorn sheep sub-populations.**

The badlands are the remains of an ancient flood plain eroded by the White River for thousands of years. Elevated sod buttes, deep gorges, and badlands pinnacles characterize the landscape and separate the upper and lower mixed-grass-prairie steppes. Grass species common on the steppes include western wheat (*Agropyron smithii*), needle-and-thread grasses (*Stipa comata* and *S. viridula*), blue grama (*Bouteloua gracilis*), and buffalo grass (*Buchloe dactyloides*) (Batt 1991). Slumps, created by erosion undercutting large portions of sod buttes that slid downslope relatively intact, are important harbors of scattered juniper stands (*Juniperus scopulorum* and *J. horizontalis*), water, and wildlife. Ponderosa pines (*Pinus ponderosa*) occur on some elevated sod buttes and cottonwoods (*Populus deltoides*) are found along the drainages.

The climate is characterized by long, cold winters and hot, dry summers. January is the coldest month and July the hottest, with 40-year, mean-maximum temperatures of -15.1 and 32.5 degrees Celsius, respectively. Mean annual precipitation is 39.6 cm.

### Past

Bighorn sheep management at Badlands began in 1964 when 22 Rocky Mountain bighorn sheep (*Ovis canadensis*) from Pikes Peak in Colorado were introduced into a 370-acre enclosure in the Pinnacles area. This was the result of a cooperative effort with the South Dakota Department of Game, Fish, and Parks (SDGF&P). The goal was to establish a captive-breeding program from which translocations could be made to several areas of suitable habitat in South Dakota within and outside the boundaries of Badlands (Hjort and Hodgins 1964). In 1967, after a number of difficulties with the health of the sheep and a final loss of 13 individuals attributed to *Pasteurella*, 14 sheep were released to the greater badlands ecosystem (Hazeltine 1967).

NPS management activities from 1967 to 1987 consisted of opportunistic observations by park personnel and a single, one-week ground count of the Pinnacles area in 1980. During this survey, a minimum of 27 sheep were observed—eight rams, nine ewes, two yearlings (one male and one female), and eight lambs (McCutchen 1980).

In 1987, at the initiation of SDGF&P, NPS entered into a memorandum of understanding to complete a research study of the bighorn sheep population. The goals were to determine the status of the population and identify the feasibility of translocations to other areas in South Dakota while ensuring the continued survival and stability of the badlands population (Badlands National Park 1987). As the lead agency, SDGF&P assumed the majority of the financial, personnel, and equipment expenses for the study. A total of six sheep were radio-collared and periodically monitored through 1990. In 1990 the population, estimated at 130 to 200 individuals, was healthy and expanding. Recommendations included continuing monitoring with an emphasis on lamb production and recruitment and additional sampling for determining the population's genetic structure (Benzon 1992).

In 1991, a multi-park bighorn sheep restoration initiative, funded by the NPS Natural Resource Preservation Program and under the direction of Francis Singer, was initiated. Representatives from NPS, the Oglala Sioux Parks and Recreation Authority, the National Biological Service (now the U.S. Geological Survey Biological Resources Division), USFS, SDGF&P, and several universities were instrumental in the planning and implementation of the initiative at Badlands National Park.

In February 1992, in partial fulfillment of the intent of the 1964 cooperative agreement and based on a study completed by SDGF&P, four ewes and one ram were removed from the Pinnacles sub-population and translocated to Spring Canyon in the Black Hills. This translocation of sheep however, actually marked the beginning of a deteriorating relationship between Badlands National Park and SDGF&P. And although department employees individually participated in Badlands manage-

ment activities, the agencies ceased to actively work together on bighorn sheep management issues—the implications of which became apparent later on.

During the same capture, 19 sheep in the Pinnacles sub-population and seven in the Stronghold sub-population were sampled and radio-collared. Data were collected on home range, habitat utilization, demographics, foraging ecology, disease ecology, and genetics (Singer and Gudorf 1999). One outcome of the 1991 initiative was the development of a habitat suitability model. The model suggested that the habitat could support three to five times the number of sheep that presently occupied the range. Several areas within the park were identified for restoration, and the recommendation was to establish a meta-population of sheep within the greater badlands ecosystem (Sweanor et. al. 1995).

In 1996, relying on a 1994 survey which estimated the Pinnacles sub-population to be within the estimated carrying capacity of 90 to 170 individuals and in a healthy and expanding state, a plan was developed to guide the restoration of sheep into Cedar Pass (Runge 1996). And in October 1996, 16 sheep were captured in Pinnacles and translocated to Cedar Pass. The translocation consisted of three young adult rams, one yearling ram, eleven adult ewes, and one ewe lamb.

In October 1998 and March 1999, 16 sheep were radio-collared in the Pinnacles and Stronghold sub-populations for disease sampling and population monitoring. This came about as a result of a die-off of ewes in Cedar Pass in 1997 and the observation of fewer-than-expected numbers of ewes in the Pinnacles during the 1996 translocation.

Since then, monitoring has focused on opportunistic observations of individuals in all sub-populations outside of the lambing and rutting period. Intensive observations of radio-collared ewes are completed during May and June to estimate lamb production, survival, and recruitment. Intensive observations of all radio-collared individuals during the rut gives further information on survival and recruitment and the distribution of the rams between the three sub-populations.

So, where are we now?

## Present

The population of bighorn sheep in Badlands National Park is currently composed of three sub-populations: Pinnacles, Cedar Pass, and Stronghold. Fifty-four individual sheep were observed in a ground survey in November 2000 and the population was estimated to be 58-74 individuals (Table 20.1). Cedar Pass accounted for 23, Stronghold for 5-12, and Pinnacles for three resident ewes, yearlings, and lambs with an additional 26-36 mature rams. While the mature rams were observed in all three areas, they are not necessarily associated with an individual sub-population. Past observations indicate that the majority of the mature rams summer near Hay Butte in the Sage Creek Wilderness Area and, while some rams winter in Cedar Pass, all usually leave the area by the beginning of April. There are a few rams resident in the Stronghold.

Based on mean estimates, mature rams account for 47%, adult ewes for 23%, yearlings for 8%, and lambs for 22% of the population. These results indicate that we have a population skewed towards rams by approximately two to one. The very high lamb-to-ewe ratio would normally indicate an increasing population. This value, however, reflects the high productivity and recruitment observed in Cedar Pass and the recent loss of four radio-collared ewes, three in the Stronghold and one in Cedar Pass. All those yearlings and adults observed during the survey for which health could be assessed were judged to be in good condition, with the exception of one two-year-old female that was in fair condition. The lambs all showed excellent body condition.

So, where do we go from here?

	<b>Pinnacles</b>	<b>Cedar Pass</b>	<b>Stronghold</b>	<b>Totals</b>
<b>Rams</b>	21-27	1	4-8	26-36 (47%)
<b>Ewes</b>	2	9	3-6	14-17 (23%)
<b>Yearlings</b>	0	4	1	5 (8%)
<b>Lambs</b>	1	10	2-5	13-16 (22%)
<b>Totals</b>	24-30	24	10-20	58-74

**Table 20.1. Present bighorn sheep population estimate from fall 2000 survey. Single numbers represent absolute counts of known individuals. Ram numbers reflect the sub-population that defines their summer range and not the distribution observed during the survey.**

### Future

The recommended goal is to have a healthy, stable meta-population of bighorn sheep in the greater badlands ecosystem with high potential for long-term viability. A meta-population is desired to reduce the effect of stochastic disease events, maximize genetic resources, and provide source stock for translocations. This means establishing a minimum of 300 to 400 sheep dispersed between the suitable habitat areas within the park (Gross et. al. 1999). The prospects are bleak for the present population to expand into all available habitat and grow to the desired levels in the very near future, so Badlands management has the responsibility to intervene and assist.

Given the current situation, future plans for bighorn sheep management at Badlands center around additional translocations. These would effectively increase the founder size and enhance the long-term persistence of the population (Singer et. al. 1999).

In 1997, Singer submitted a grant proposal to Canon, Inc., and the National Park Foundation; as a result, \$35,000 was received in 1998 to assist with the expenses of two additional translocations of 25 animals each from external source herds to Badlands. In the fall of 2000, this was supplemented with an additional \$50,000 from the new Biological Resources Management Division of NPS.

So, how do we achieve our recommended goal?

Herein lies the problem with the lack of active cooperation between Badlands and SDGF&P. In 1998, a request for sheep was sent to the Colorado Division of Wildlife, with initial favorable results for 2000 or 2001. A requested letter of endorsement from SDGF&P was, however, less supportive, and it became clear that SDGF&P was also looking for sheep. This left the park in a vulnerable position when the Colorado Division of Wildlife made it clear that Badlands would not get sheep without unqualified support from SDGF&P.

During 1999, biologists and managers in all the western states and provinces having Rocky Mountain bighorn sheep were contacted regarding the availability of sheep for translocation to Badlands. A source of sheep was identified in Alberta. The source herd was infected with contagious ecthyma, however. Given that the Badlands population is currently free from contagious ecthyma, the decision was made to wait an additional year to see if a source population from Colorado was a possibility.

At this point it was clear that the approach to bighorn sheep management at Badlands National Park had to change and that change had to include cooperation with SDGF&P. And while neither agency was openly unreceptive, there had been a lack of communication regarding bighorn sheep management both in and outside of the park boundaries—we knew little about their populations and future plans and they, in turn, knew little about ours.

Plans were made to organize a meeting in the summer of 2000 between SDGF&P biologists and managers and the new Badlands resource management team scheduled to be in place in late 1999. During this meeting it was clear that both agencies shared a common vision: that of more sheep on the mountain in the form a healthy, stable meta-population of bighorn sheep in western South Dakota. In this vision, all populations, including those in Badlands National Park, were part of the larger meta-population. The question remained of how to get there when each agency was actively seeking sheep for translocations and considered its needs to be more important than the other's.

### **Vision**

The first priority should be the development of a management plan for bighorn sheep in Badlands National Park. Development should primarily be the responsibility of NPS but should also include representatives from SDGF&P, the Oglala Sioux Tribe, USFS, and other research professionals.

This should be a comprehensive plan that outlines, at a minimum, short- and long-term goals, means and methods of achieving these goals, and basic monitoring and sampling activities. Research needs to guide management should be identified and prioritized. The plan should also address the issue of how the population will be managed once size goals have been met. Without such a comprehensive management plan, bighorn sheep management will likely continue to be reactionary in nature, research needs continue to be unmet, and restoration delayed.

The second priority should be to include this plan in a larger, long-term management plan for bighorn sheep in western South Dakota. Included should be a statewide restoration plan identifying suitable habitat and prioritizing restoration areas. Some of these areas will be outside the boundaries of Badlands National Park and some will be inside. Some existing populations may need to be supplemented. As part of the restoration plan, we need to recommend source populations for individual translocations. There will undoubtedly be different needs for different supplements and translocations. Some situations will require indigenous, external-source populations. In others it may be appropriate to supplement the Badlands population with sheep from the Black Hills, and vice versa. Recommendations should be made for post-release monitoring. These may also vary by translocation.

This may sound overwhelming. However, it is clear in this situation that we cannot continue to act independently of one another. It is time to cross the boundaries, combine resources, and share knowledge to achieve the larger goal. Steps have been made in this direction. Badlands staff recently began to participate in the Northern Wild Sheep and Goat Council symposia, and last year volunteered to co-host the 2002 symposium with SDGF&P. At the July 2000 meeting, SDGF&P presented Badlands with the beginnings of a management plan for our review. Notably, the plan included the park population as part of a larger meta-population in western South Dakota. Work was delegated and assignments made to track down source populations of sheep that could meet both our immediate needs. Knowledge was shared and agreements made to work more closely on bighorn sheep management issues in the future.

Working together, I believe we can realize our shared vision: that of more sheep on the mountain in the form of a healthy, stable meta-population of bighorn sheep in western South Dakota.

### **References**

Badlands National Park. 1987. Memorandum of understanding between the National Park Service and the South Dakota Department of Game, Fish and Parks for the study of the Pinnacles bighorn sheep population. Badlands National Park, So. Dak.: National Park Service.

- Batt, J.E. 1991. Grassland community types of Badlands National Park, SD. Unpublished report. Badlands National Park, So. Dak.: National Park Service.
- Benzon, T. 1992. Population status of Badlands National Park bighorn sheep herd. Unpublished report. Rapid City, So. Dak.: South Dakota Department of Game, Fish, and Parks.
- Gross, J.E., F.J. Singer, and M.E. Moses. 1999. Assessing restoration decisions to enhance the persistence of translocated populations of bighorn sheep: implications of disease. Pp. 104-121 in *Restoration of Bighorn Sheep Metapopulations into and near 15 National Parks: Conservation Biology of a Severely Fragmented Species. Volume III. Research Findings*. F.J. Singer and M.A. Gudorf, eds. Fort Collins, Colo.: U.S. Geological Survey Midcontinent Ecological Science Center.
- Hazeltine, B.A. 1967. Memorandum of bighorn sheep die-off. Badlands National Park, So. Dak.: National Park Service.
- Hjort, F.A., and R.A. Hodgins. 1964. Cooperative agreement between the National Park Service and the South Dakota Department of Game, Fish and Parks for the reintroduction and management of bighorn sheep. Badlands National Park, So. Dak.: National Park Service.
- McCutchen, H.E. 1980. A preliminary report on the status of bighorn sheep in Badlands National Park, SD. Unpublished report. Badlands National Park, So. Dak.: National Park Service.
- Runge, R. 1996. *Restoration Plan for Rocky Mountain Bighorn Sheep at Cedar Pass, Badlands National Park, September 1996*. Badlands National Park, So. Dak.: National Park Service.
- Singer, F.J., and M.A. Gudorf, eds. 1999. *Restoration of Bighorn Sheep Metapopulations into and near 15 National Parks: Conservation Biology of a Severely Fragmented Species. Volume III. Research Findings*. Fort Collins, Colo.: U.S. Geological Survey Midcontinent Ecological Science Center.
- Singer, F.J., V.C.M. Papouchis, and K.A. Symonds. 1999. Translocation as a tool for restoring populations of bighorn sheep, *Ovis canadensis*. Pp. 43-51 in *Restoration of Bighorn Sheep Metapopulations into and near 15 National Parks: Conservation Biology of a Severely Fragmented Species. Volume III. Research Findings*. F.J. Singer and M.A. Gudorf, eds. Fort Collins, Colo.: U.S. Geological Survey Midcontinent Ecological Science Center.
- Sweanor, P., M. Gudorf, F. Singer, T. Benzon, J. Berger, B. Bessken, S. Cordts, C. Douglas, M. Moses, G. Plumb, R. Sherman, and E. Williams. 1995. Bighorn sheep habitat assessment of the greater Badlands National Park area. National Park Service and National Biological Service cooperative report. Badlands National Park, So. Dak.: National Park Service.